A new species of *Cyana* from Northern Luzon (Philippines) belonging to the *lunulata* group, with an analysis of differential features and evaluation of elements for group recognition (Lepidoptera, Arctiidae, Lithosiinae)

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Abstract: In the absence of apomorphies for the criteria by which Černý (1993) defined his use of the name *Doliche* Walker, 1854 for the known 28 Philippine species, the synonym *Cyana* Walker, 1854 (described in the same work) is reinstated for this genus following general tradition. The discovery of a new *Cyana* species in NE Luzon enabled the recognition of two, so far "unknown" closely resembling females of the species *C. lunulata* and *C. alexi,* which are described in detail for the first time. These species and their genitalia are compared with the other 4 species of this so-called "*lunulata*-group". On the basis of an assumed order of structural simplicity and linked by overlap in parallel trend lines, the 6 so far known species of this group are placed in a hypothetical phylogenetic order. *Cyana* ***janinae*** **sp. n.** from NE Luzon, Aurora, Sierra Madre, 13 km W Dibulo, is described and illustrated; the male holotype is deposited in Senckenberg-Museum, Frankfurt am Main, Germany. The re-establishment of the generic name *Doliche* Walker, 1854 (= *Cyana* Walker, 1854 **syn. rev.**) results in the following changed combinations: *Cyana euryxantha* (Hampson, 1914) **comb. rev.,** *C. lunulata* Semper, 1899 **comb. rev.** and *C. phycomata* Wileman & West, 1928 **comb. rev.** are revised combinations, and *C. alexi* (Černý, 1993) **comb. n.,** *C. geminipuncta* (Černý, 1993) **comb. n.,** *C. v-nigrum* (Černý, 1993) **comb. n.,** *C. v-nigrum visayana* (Černý, 1993) **comb. n.** and *C. vespertata* (Černý, 1993) **comb. n.** are new combinations with *Cyana*.

Eine neue Art der Gattung *Cyana* aus der *lunulata*-Gruppe von Nordluzon (Philippinen), mit einer Analyse der Merkmalsunterschiede und einer Ausarbeitung der Merkmale zur Gruppenerkennung (Lepidoptera, Arctiidae, Lithosiinae)

Zusammenfassung: Wegen des Mangels an erkennbaren Apomorphien für die Merkmale, mit denen Černý (1993) den Gebrauch des Gattungsnamens *Doliche* Walker, 1854 für die damals bekannten 28 philippinischen Arten rechtfertigte, wird das gleichzeitig erschienene Synonym *Cyana* Walker, 1854 wieder in Übereinstimmung mit anderen Autoren verwendet. Die Entdeckung einer neuen *Cyana*-Art in NE-Luzon ermöglichte die Erkennung zweier vorher „unbekannter" Weibchen ähnlich der von *C. lunulata* und *C. alexi,* die hier erstmals beschrieben werden. Diese Arten und ihre Genitalarmaturen werden mit den anderen 4 Arten dieser sogenannten „*lunulata*-Gruppe" verglichen. Auf der Basis einer angenommenen Reihenfolge strukturellen Primitivität und vermuteten parallelen Entwicklungstrends werden die 6 von den Philippinen bekannten Arten dieser „*lunulata*-Gruppe" in einer hypothetischen phylogenetischen Reihenfolge angeordnet. Die neue Art *Cyana* ***janinae*** **sp. n.** wird von NE-Luzon, Aurora, Sierra Madre, 13 km W Dibulo, beschrieben und abgebildet; der männliche Holotypus befindet sich im Senckenberg-Museum, Frankfurt am Main, Deutschland. Aus der Synonymisierung von *Doliche* Walker, 1854 mit *Cyana* Walker, 1854 (**syn. rev.**) resultieren die folgenden Kombinationsänderungen: *Cyana euryxantha* (Hampson, 1914) **comb. rev.,** *C. lunulata* Semper, 1899 **comb. rev.** und *C. phycomata* Wileman & West, 1928 **comb. rev.** sind revidierte Kombinationen, und *C. alexi* (Černý, 1993) **comb. n.,** *C. geminipuncta* (Černý, 1993) **comb. n.,** *C. v-nigrum* (Černý, 1993) **comb. n.,** *C. v-nigrum visayana* (Černý, 1993) **comb. n.** und *C. vespertata* (Černý, 1993) **comb. n.** sind neue Kombinationen mit *Cyana*.

Introductory note on the taxonomy of *Cyana* Walker, 1854 versus *Doliche* Walker, 1854

Cyana Walker, 1854 had been recognized as the valid name for the genus, based on the type species *Cyana detrita* Walker, 1854, and had been in use by most authors working on this Lithosiine species group (e.g., Semper 1899, Roepke 1946, Roesler et al. 1976, Kishida 1991, Holloway 2001) for over a century. Černý (1993) attributed the 28 Philippine species dealt with to the synchronously published (see Watson et al. 1980) genus name *Doliche* Walker, 1854, with the type species *Doliche gelida* Walker, 1854, because of closer agreement of some basic features of the Philippine species to that type species: primarily the spiny sclerotisations on the phallus shaft as well as some external features, fasciation, and male sexual characteristics, some of which he overemphasized. Upon availability of more detailed data from a wider range of species it became clear that scobination on the vesica of the phallus remains a valuable discriminative parameter for a section of this genus, but lacks apomorphic state even within the Philippine *Cyana* species, such as the members of the *C. geminipuncta* (Černý, 1993) **comb. n.** and the *C. vespertata* (Černý, 1993) **comb. n.** groups which have no ornamentation at all on the phallus shaft. It has therefore been decided to retain the widely adopted name *Cyana* Walker, 1954 for the Philippine species and to accept the synonymy *Cyana* (= *Doliche* **syn. rev.**) as had earlier been done by Holloway (2001) for the Bornean species. In the following text the synonym *Doliche* (or *D.*) is added in parentheses when used in discussions or citations.

Introduction

Černý (1993) described 11 new *Cyana* species (as *Doliche*), which brought the total of species of this genus recorded from the Philippines to 28. Since 2003, the resident author undertook monthly inventarisations, at over 100 locations on nearly all Philippine islands, recaptured 25 species, and established specimen samples from every new biotope and location. Thanks to the availability of Černý's pioneer work almost all species could be identified, except for about 7 (or 25%) of presumed "new" species undergoing, for the first undescribed species, analysis and description below.

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The usual standard morphological differential criteria based on size, colour and fasciae, as well as structural criteria visible from embedded ♂ and ♀ genital structures in slides, did not always allow precise classification. Although Černý (1993) compared 4 species (*Cyana euryxantha* (Hampson, 1914) **comb. rev.,** *C. v-nigrum* (Černý, 1993) **comb. n.,** *C. alexi* (Černý, 1993) **comb. n.,** and *C. phycomata* Wileman & West, 1928 **comb. rev.**), he did not allocate these explicitly to the so-called *C. lunulata*-group of which all ♂♂ do have in common a rugose band on the phallus at one third of its distal length and a hyaline vesica without spines (cornuti).

This led to the search for further diagnostic parameters, such as: the likely construction details of the dissected male valve, the observed dentation at the apex of the phallus hull, the three-dimensional structure of the phallus vesica (in ♂♂) and (in ♀♀) the sclerotisations of the copulatory atrium, the ductus bursae and the bursa, internal bursa structures and pseudobursa positions as well as the earlier recognized entry point and position of the ductus seminalis and glandular affluent vasculae and glands. Hereto, a selective tissue dye technique was developed, which will be described below.

General phenological and ecological observations

Since the author collected all the material used in this study himself, over a period of 5 years, some experiences can be laid down, which museum-based taxonomists cannot easily distract from specimen labels.

In the Philippines, *Cyana* species are usually common in non-urban environments. They could be used as indicators for air pollution. They fly abundantly when there is no or very little wind. They have strong legs with 2 pairs of prominent tibial spurs and often "hook" firmly to the spongy base inside a killing jar. They will probably not be blown away during frequent strong tropical storms. They are often very local. This predestinates them to be used as suitable candidates for inter-island zoogeographical and phylogenetical studies. They can be grouped into 2 apparent ecological classes:

- the exclusive forest species and
- those which can usually be caught in disturbed, more open, even semi-agricultural habitats.

Philippine forest species of *Cyana* have circular or oblong white basal spots on the forewing in common. This spot is, in part or fully, encircled by a sharp, contrasting border, either black or otherwise. The front wings are usually more orangy coloured (especially ♀♀). Although ♀♀ of forest species are rarely caught (usually around 2–4%) it was experienced that a much higher female sex ratio could be obtained (20–50%) by collecting closer to the likely breeding grounds. This is assumed on the basis of a close to 1:1 sex ratio obtained in breeding experiments by Černý (pers. comm.). For catching ♀♀, one has to move into a choice of surrounding biotopes till successful. In case of *Cyana janinae* sp. n. it appeared that regrown steep slopes, mostly landslide-induced, are the optimal collecting ground (Fig. 7). Specimens were never caught inside surrounding dense forests. ♂♂ of *C. janinae,* which obviously roam around farther away from their breeding grounds, can be collected along trails, ♀♀ apparently being stronger territorially bound, or perhaps more conservative, only at nearby clearings.

Philippine non-forest species of *Cyana* have more or less transverse fasciae. The degree of success in achieving straight tranverse fascies lines out of (perhaps, past) circles can be used as morphological descriminator. The usefulness of an empirical criterion regarding angles of fascies or black margins versus the wing perimeter is acknowledged. It provides strong support for morphological identification of almost all Philippine and some Bornean species, but does not necessarily reflect phylogenetical relationship.

As to minimize the risks for misinterpretation of morphological features arisen from selection trends by predatory regimes such as birds, bats, lizards or spiders, abiotic factors, such as microclimate, especially wind, which are likely very different in dense/lights forest, one should preferably support classification by structural parameters which are less prone to external selection pressure. This has been envisaged in this study as to enhance the chance for identifying genuine species' relationships.

Material and methods

Adult specimens were collected using Mercury vapor (ML) light sources of 250–500 W together with an actinic UV light fluorescent tube inside a ring-shaped mosquito screen tower. Collections were normally made during new moon (more or less for a week) from 18.00 till 6.00 h. Within an area, collection sites were frequently changed. Same locations were visited 2–3× per year, when possible. Samples were stored deep frozen, and per location 6 specimens of either sex mounted and stored under airconditioning. Synthetic pyrethroid pesticides are used as dusts for the prevention of storage pests, especially Psocoptera. Thymol vapor is used for the prevention of moult.

Genitalia preparations were made by boiling abdomen for 30–45 min in 10 % KOH or overnight in 4 % solution. The latter favours the diffusion of bubbles outside cavities and folds. Prior to dissection of structural parts, the sample is dipped in a light blue solution of magenta Epson® printing ink. This dyes the tissues, but does not fully stain sclerotized parts. Chitinized skeleton parts are stepwise removed ventrally, leaving the ducti and glandular components in position. The vesica is protruded from the phallus hull using water pressure applied via a tight fitting syringe inserted in the short cut ductus ejaculatorius opening. The needle point has to be shortened using a micro-sanding disc and sometimes the syringe diameter has to be reduced.

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Steps were sequentially photographed using a Nikon® SMZ 1000 stereo-zoom microscope with attached Coolpix® 4500 digital camera and 2 fibre optic and 1 ring light source. GP photography is done in glycerine. After passing the objects through 95 % ethanol, the dye is fixed. Reversal of the dye is possible when objects are brought back into water via passing through 95% ethanol. GPs are stored in mini-capsules in glycerine on specimen pins. GPs are coded: JHL yr/gp code, here for Lithosiinae LT/sequence #. Images edited using Photoshop® CS2. Holotypes carry red, paratypes blue labels.

Abbreviations used

CJLP	Collection Johannes Lourens, Philippines, Luzon.
Fw.	forewing.
Fwl.	forewing length (measured in a straight line from the wing base to the most distant point of the apex, without the thorax.
HT	holotype[s].
Hw.	hindwing.
MV	mercury vapor lights.
PT	paratype[s].
SMFL	Lepidoptera collection of Senckenberg-Museum, Frankfurt am Main, Germany.

Description of the new species from Luzon

Cyana janinae sp. n.

Fig. 1a HT ♂, Fig. 1b PT ♂, Fig. 1c PT ♀; genitalia compared and described in Tab. 1: ♂ GP JHL 08LT33 (illustrated in Figs. 1d–1i), ♂ GP JHL 09LT49, and in Tab. 2: ♀ GP JHL 08LT34 (illustrated in Figs. 1j–1l).

Holotype ♂ (Fig. 1a): Philippines, E Luzon, Aurora, Sierra Madre, 13 km W Dibulo, 16°32.886' N, 122°14.134' E, 585 m, 5.–6. ix. 2007, J. H. Lourens leg. (now deposited in SMFL; SMFL type catalogue no. 4252).

Paratypes: in total 12 ♂♂, 2 ♀♀, collected within a radius of 3 km of the type locality at slightly differing elevations on: 3. ix. 2006 (1 ♂), 21.–22. ix. 2006 (6 ♂♂, 1 ♀); 14.–15. vi. 2007 (4 ♂♂), 5.–6. ix. 2007 (1 ♂, 1 ♀), all J. H. Lourens leg., in CJLP; 1 ♂ in SMFL.

Derivatio nominis: This species is named after my daughter Janine Amelie Lourens in recognition for her help with the preparation of the figures.

Description

♂, head: vertex white, frons white, at the margin with the labrum a narrow bright orange crescent. Palps crimson and antennae ochrous brown. First antennal segment white, sclerites at wingbase with a white lateral upper section, otherwise crimson. Patagia crimson, tegulae crimson except for a lateral base section, which is white.

Thorax white, with a 0.5 mm transverse crimson band in the centre, and, at the white metathoracal hump, a crimson distal crescent.

Fwl. 16 mm. Fw. predominantly carmine, with a conspicuous 2.5 mm diameter zinc-oxide white basal spot in the centre of the wing, between the subcosta and anal veins, not reaching the margins. The spot is slightly pecten-shaped, with its foot towards the wingbase, the two sides straight, following the respective veins, distally connected to a regular arc. The inside of the spot is black lined, proximal and distally thicker than the sides.

Over the 1a and 1b cells of the fw. lies a 7 mm × 1 mm white parallel band, starting at the centre of the circular section of the lobe (underside), towards the apex. The centre of this oblong white field is covered by a fringe of long hairs, originating from the costa.

The black cellspot at the end of the discal cell is single in 6 specimens, and double in 8 further specimens, having a tangential, smaller 2nd spot. The HT has 1 spot, which is surrounded by a narrow encircling band of white scales, merging with the costal white transverse line. A transverse black and white band is at ¾ of the distal part of the fw. The black line is incomplete, starting at the base of vein R5, gradually increasing in width to the centre and meeting the outer border obliquely, slightly bent towards the outer wing border. The upper part of this line is interrupted on the radius by a narrowing crimson protrusion of the marginal band, leaving a small part of white near Sc visible. The margin is slightly lighter in colour, closest to tangerine.

The hw. is light peach-coloured. Cilia of both wings are ochrous.

Abdomen slim, dorsally ochrous and underside white. The legs are ochrous, laterally crimson. The second pair of spurs on the hind legs is positioned below the centre of the tibia.

♀: All sections of the head, thorax and abdomen are the same as in the ♂, including the wing facies. Wings slightly larger, lfw. 17 mm. The cell spot is more prominent, and the white zone surrounding it wider towards the upper, partly visible postmedian band. Cell spot, distally separated from the upper postmedian (remaining) band by a narrow white band, curved towards the place where in ♂♂ sometimes a second cell spot occurs. The cell spot is connected with a longitudinal crimson wedge towards the wingbase. The median white spot meets the costa obtusely, widening towards the wingbase.

The white line between postmedian and margin is narrower than in ♂♂. The marginal band is wider and the narrowing protrusion more robust. On its inner border there is an incomplete black line. It arises with a slight curve from the inner margin, is straight in the centre, perpendicular with the inner and outer margins and interrupted by the carmine protrusion from the margin. Towards the costa, the black line runs a small stretch over the R-vein branches, but does not fully reach the costa. The bordering adjacent small white spot in the apical section is slightly larger than in the male. Hw. peach coloured. Abdomen broad, peach coloured, underside white, including the coxae.

Genitalia of ♂♂ and ♀♀ of the species dealt with here are described and compared in Tabs. 1 and 2.

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Notes on the ♀♀ of *Cyana alexi* and other species

The recent discovery of the ♀ of *C. alexi* at light revealed that the ♀ in Semper's collection, now in SMFL (illustrated by Černý 1993: fig. 29b), so far held for the allotypical partner of the ♂ of *C. lunulata* (illustrated by Semper 1899: pl. 59, fig. 12; also by Černý 1993: fig. 29a), might well be a specimen of *C. alexi* or of another species. This became evident on the availability of larger numbers of *C. lunulata* ♂♂ from Leyte and E Mindanao, which were, on several independent occasions, collected simultaneously in relatively large numbers together with an unknown, but very similar ♀. The frequency incidence of the simultaneous catch provided a high degree of likelihood that these were partners. Further, upon the availability of *C. janinae* sp. n., and because of the observed low sexual dimorphism in ♂♂ and ♀♀ of this species, the similarity and diagnostic value of the white basal spot, which also prevails in *C. lunulata* ♂♂ and ♀♀, became evident. Finally, after the ♀ genitalia structures had been documented (Table 2) and the "unknown female" could with certainty be assigned to fit within the variabilty of the *C. lunulata* group, there remained no more doubt that the ♀ described here is indeed the *C. lunulata* ♀.

First description of the ♀ of *Cyana lunulata* Semper, 1899 comb. rev.

Fig. 2b ♀; ♀ genitalia described and compared in Tab. 2: GP JHL 08LT36 (illustrated in Figs. 2g–2i).

> **Material studied** (*C. lunulata* ♀♀), all Philippines: **Leyte:** 1 ♀, SW, 20 km N Maasin, Hinapu Dacu, 600 m, 10°16' N, 124°55' E, 6.–7. x. 2005, on a hilltop bordering primary forest, J. H. Lourens leg. (now deposited in SMFL). 8 ♀♀: Philippines, C Leyte, Hilusig, W Mahaplag, Mt. Balocawe, 700 m, 10°40.742' N, 124°55.270' E, 19.–20. v. 2005. 4 ♀♀: same locality, 15.–19. v. 2005; all J. H. Lourens leg. (in CJLP). – **Mindanao:** 3 ♀♀, Baracatan, E. slope of Mt. Apo 1050 m, 7°0.513' N, 125°22.498' E, all J. H. Lourens leg. (in CJLP).

Head: Vertex and antennae base white, frons white with the margin to the labrum tinged with few layers of pale orange scales. Palps ochrous, with crimson laterally. Antennae crimson.

Thorax white, with a transverse ochrous band in the centre, and a mesothoracal white hump, ending in a narrow light orange crescent tip. Tegulae white, with a distal carmine border and carrying long hairs, projecting dorsally.

Wings: ground colour white, with a large oblong basal white spot, and wide crimson transverse fasciae, except the marginal band, which is golden ochrous, and an inner border heavily dusted with crimson scales.

Wing features: the 0.6 mm fw. base is white, the subbasal crimson and 1 mm wide, from the costa following the contours of the inner border of the basal spot till the anal wing margin. It passes under the white spot, and connects to the antemedian band.

The prominent white basal spot of 3.5 mm × 2.5 mm touches the costa and is semi-circular, slightly black dusted on the costa, suggesting that a small piece has folded over the edge.

The white spot is encircled by a black ring, except for the white open section bordering the costa. The lower part is V-shaped, with the base not reaching the outer border. The V base has a thicker aggregate of black scales, as has the inner line on small patches. The distal leg of the V has basad a concave incursion on the Cu.

The antemedian band is 1.5 mm wide, fully encircling the white spot proximally and a small concave protrusion towards the black cell spot. Over the Cu there is a small crimson connecting band with the postmedian, The base stands strongly obtuse towards the wing end. The outer border has a straight black line in the centre, which is obtusely bordering on either side and followed by the crimson of the postmedian.

The marginal band is golden ochrous, with a crimson inner border. At R_{4-5} a crimson protrusion towards the cell, pointing at the centre black cell spot.

The costa is laterally ochrous, till the antemarginal.

Abdomen dorsally ochrous, ventrally creamy white, distal 2 segments white. Legs ochrous, frontlegs laterally carmine dusted, coxae mixed white and ochrous. Hind tibia 5 mm, with thorn pairs at 3 and 5 mm.

Genitalia are described in Tab. 2 (GP JHL 08LT36).

Concise diagnostic description of *Cyana lunulata* ♂♂

Fig. 2a ♂; genitalia described and compared in Tab. 1: ♂ GP JHL 08LT35 (illustrated in Figs. 2c–2f); see also Černý (1993) for comparison with the above described ♀.

Ground colour of fw. white, the basal half bright crimson, with a 3.5 mm × 2.5 mm oblong white spot, surrounded by a black contrasting band, interrupted at the ochrous to orange costa over the upper section. It gives the impression that the basal spot is open at the top. The black ring has a V-shape towards the anal veins, but clearly does not meet the border. The antemedian protrudes with a narrow wedge towards the cell spots in the upper section of the discal cell. Below, on the inner base of the cell a black wedge-shaped line connects the antemedian with the post median crimson fasciae. The width of this parallel black cellspot is variable. Outer margin of the postmedian black transverse line, straight in the centre, dichotome split nearing the costa: one part obtuse towards the apex in black scales, the other as black hairs, originating from the hairfringe, arising from the costa. Inner border of postmedian crimson, with a narrowing bridge connecting to the ante-median at the Cu vein. Hw. light golden ochrous, not as deep as the outer margin of the marginal band.

> **Further distribution records of *C. lunulata* ♂♂,** all from Philippines: **Leyte:** Central: 5 ♂♂, Hilusig, W Mahaplag, Mt. Balocawe, 700 m, 10°40.742' N, 124°55.270' E, 29.–30. iii. 2005; 7 ♂♂, same locality, 19.–20. v. 2005; 1 ♂, same locality, 3. xii. 2005, J. H. Lourens & A. Schintlmeister leg.; 4 ♂♂, same locality, 27.–28. vi. 2006; 3 ♂♂, same locality, 15.–19. v. 2007. North: 6 ♂♂, 12 km E Ormoc, Lake Danao, 650 m,

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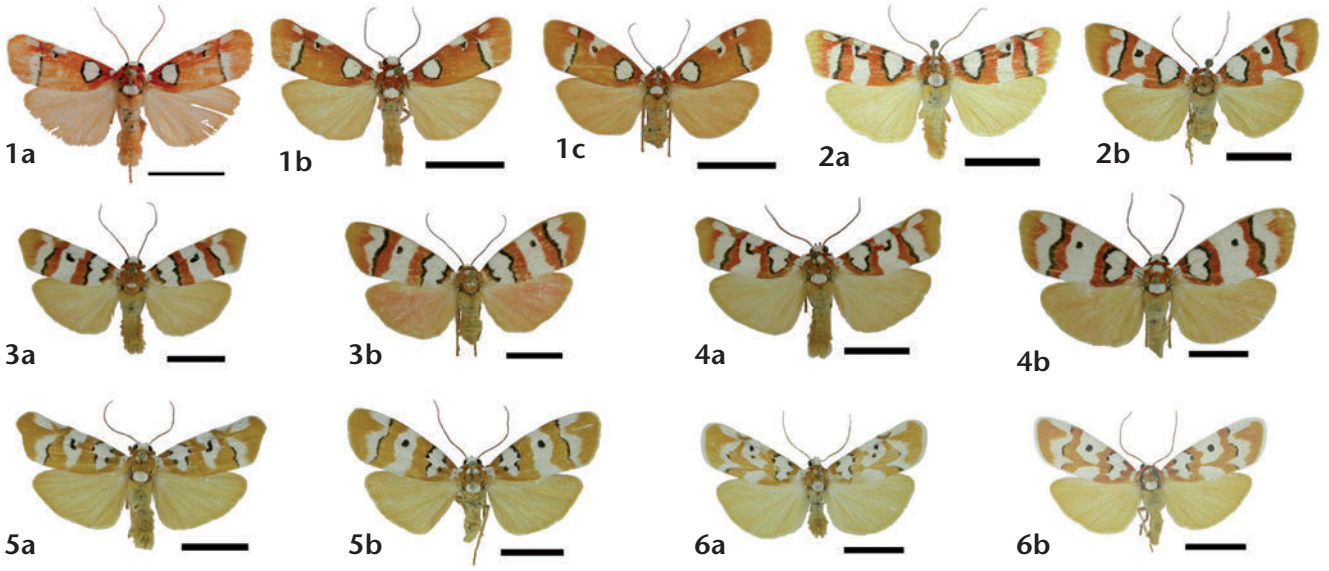

Plate 1: Imagines of *Cyana* species. **Figs. 1a–1c:** *C. janinae* n. sp., NE Luzon. **1a:** ♂ HT; **1b:** ♂ PT; **1c:** ♀ PT. **Figs. 2a/2b:** *C. lunulata*, SW Leyte. **2a:** ♂; **2b:** ♀. **Figs. 3a/3b:** *C. phycomata*. **3a:** ♂, E Mindanao; **3b:** ♀, C Leyte. **Figs. 4a/4b:** *C. alexi*. **4a:** ♂, C Leyte; **4b:** ♀, E Mindanao. **Figs. 5a/5b:** *C. v-nigrum v-nigrum*. **5a:** ♂, E Luzon; **5b:** ♀, NW Luzon. **Figs. 6a/6b:** *C. euryxantha*. **6a:** ♂, Abra/Kalinga border, C Luzon; **6b:** ♀, C Luzon. — Specimens not exactly to the same scale, scale bar = 1 cm. — **Fig. 7:** Biotope of *C. janinae* n. sp., Eastern Luzon, Sierra Madre foothills. Hilly Dipterocarp forest mixed with Fagaceae, with intermittent steep landslide-induced and man-made clearings.

11°4' N, 124°42' E, 29.–30. VI. 2006. South: 20 km N Maasin, Hinapu Dacu, 600 m, 10°16' N, 124°55' E, 6.–7. X. 2005; unless indicated otherwise leg. J. H. Lourens, in CJLP. – **Mindanao**: East: 3 ♂♂, Surigao Sur, Lianga Hanayan, 350 m, 8°42' N, 126°5' E, 29. XI.–1. XII. 2005, leg. J. H. Lourens & A. Schintlmeister, in CJLP. Surigao Sur, San Francisco, Mt. Magdiwata, 8°29' N, 125°59' E, 400 m, 2. VII. 2005, J. H. Lourens leg., in CJLP.

Cyana phycomata Wileman & West, 1928

Fig. 3a ♂, Fig. 3b ♀; genitalia description Tab. 1: ♂ GP JHL 08LT37 (illustrated in Figs. 3c–3g) and Tab. 2: ♀ GP JHL 08LT38 (illustrated in Figs. 3h–3j).

A concise description of both sexes of this species is given here to provide complete overview over the so far known species of the *C. lunulata* group. The diagnostic features

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of this species could be more focused after the ♀♀ of *C. lunulata* and *C. alexi* had been identified and further specimens from Leyte and Samar became available. See also Wileman & West (1928) and Černý (1993) for first descriptions of resp. ♂ and ♀.

Both sexes have similar fw. facies; sexual dimorphism in ♂♂ limited to size, 16 mm versus 18–20 mm of the ♀♀, wingshape of the less rounded ♂♂, with a small projection near the apex, and in the ♂: cellspot triangular and the postmarginal sinuous, black margin ending before R, not reaching C, narrower than in ♀♀. Fw. with 2 broad, 2 mm wide crimson transverse ante- and postmedian bands, and a full crimson subbasal not reaching the wing base. A broad white transverse basal field, broadly meeting the costa as well as the inner margin, dominates the facies. On both sides flanked by two large black indentations, on the subbasal M and Cu, and one in the centre of the almost straight transverse black antemedian inner border. Margins golden ochrous, with sparkling, lighter cilia. A small inward dens on R, inner margin carmine dusted. ♂ hw. ochrous, in ♀♀ darker, variably tending to carmine, especially in Leyte/Samar specimens.

Distribution records of *C. phycomata,* all from Philippines: **Mindanao:** 5 ♂♂, Agusan Sur, S Mt. Hilong-Hilong, 34 km E Ampayon, 470 m, 8°58' N, 125°49' E, 30. vi. 2005. 9 ♂♂, 1 ♀, Surigao Norte, Lianga, 8 km W Diatagon, 200 m, 8°42' N, 126°5' E, 7. vii. 2005; 10 ♂♂, Lianga Hanayan, 13 km W Diatagon, 350 m, 8°42' N, 126°6' E, 29. xi.–1. xii. 2005, J. H. Lourens & A. Schintlmeister leg.; 5 ♂♂, 1 ♀, N Lianga, 13 km W Diatagon, 320 m, 8°44.475' N, 126°5.632' E, 22.–23. v. 2007. Agusan Sur, Sta. Maria, SE Trento, 185 m, 8°1.615' N, 126° 12.322' E, 4.–5. v. 2008. 2 ♂♂, Davao Oriental, Aliwagwag, 10 km S Trento, 90 m, 7°43.667' N, 126°17.304' E, 30. iv.–1. v. 2008. 5 ♂♂, Osmeña, Ft of Mt. Hamaguitan, 95 m, 6° 40.588' N, 126°7.690' E, 3. v. 2008. 4 ♂♂, Davao Sur, Baracatan, E slope Mt Apo, 1050 m, 7°0.513' N, 125° 22.498' E, 4.–5. v. 2008. – **Leyte:** central: 5 ♂♂, 1 ♀, Hilusig, W Mahaplag, Mt. Balocawe, 600 m, 10°43' N, 124°55' E, 27.–28. vi. 2006. – **Samar:** central: 4 ♂♂, 1 ♀, 8 km S Bagacay, primary forest road, 11°47' N, 125°15' E, 21.–22. x. 2006. – All specimens leg. J. H. Lourens, except where indicated otherwise; in CJLP.

First description of the ♀ of *C. alexi* (Černý, 1993)

Fig. 4b ♀; ♀ genitalia described and compared in Tab. 2: ♀ GP JHL 09LT48 (illustrated in Figs. 4g–4i).

Material studied: 1 ♀, NE Mindanao, Surigao Norte, Lianga Hinayan, 13 km W Diatagon 8°42' N, 126°5' E, hilly Dipterocarp forest, 350 m, 29. xi.–1. xii. 2005, J. H. Lourens & A. Schintlmeister leg., in CJLP.

Head: Frons and vertex white, palpi golden ochrous, antennae orange, base segment white, the following 2 mixed with white. Thorax white with a central tangerine band, laterally pointing towards the wing base. Patagia centre white, outer half tangerine lined. Tegulae white, the outer margin toching the wing costa carmine, backward hairs golden ochrous. Caudal thoracal rhombus with a crimson crescent ending.

Wing: ground colour white, 20 mm long. Base white, 1.5 mm with a short inward dent on the crimson costa. Subbasal crimson, 1 mm wide, inner margin not reaching distal border, obtusely outward bent, merging with antemedian. A large white 4.5 mm wide and 3 mm long, oblong spot, over the full width of the wing, not covering the anal vein sector. The white spot is composed of an upper half circular part, ending before the costa. It makes the impression that the upper tip is folded over the costa. The distal half of the white spot is V-shaped. The spot is edged with an incomplete black margin, open at the costal border. On the M-vein, there are 2 black dents, pointing at each other, 1.6 mm space between. The V shaped part of the white spot is slightly inwardly slanting. The outer black margin is heavier than the inner one.

The crimson antemedian encircles half of the basal spot. At the inner border, the transition zone with the black line is golden ochrous in the outer half. Its outer border slightly rounded, expanding on the Radius, widening distally. A black circular cell spot in the relatively wide white zone between the postmedian. The postmedian is crimson, slightly undulated, with a 1 mm protrusion inward on Cu, which is followed by the black outer margin. In the centre, the black line is outwardly bulged.

The margin is narrow, 2 mm wide and golden ochrous, with an inner half border, as well as the inward, 1 mm dent on the R_{4-5}, carmine dusted. Hw. golden ochrous, the cilia slightly lighter. Abdomen dorsal golden ochrous underside whitish. Legs proximal white, lateral golden ochrous, with white rings at the joints.

The ♀ genitalia are described in Table 2.

Concise diagnostic description of the ♂ of *C. alexi*

Fig. 4a ♂; see also Černý (1993); genitalia described and compared in Tab. 1 ♂: GP JHL 09LT43, 09LT44 (illustrated in Figs. 4c–4f).

The basal white spot on the fw., with a black outer circle, which is open at the costa, but closed at the slanting distal border. The wing wide spot is placed inside a contrasting crimson/golden ochrous background, covering half the wing, formed by surrounding fasciae of subbasal and antemedian. The shape of this spot differs in the following details from the other members of this subgroup:

- The upper half of the spot is wide, the lower half V-shaped and slightly slanting to the wingbase.
- In the centre of the spot there are 2 oppositely pointing black dents, with a space of (average) 1.85 mm in between them (range 1.6–2.2 mm; widest in Mt. Apo specimen).
- The crimson postmedian is undulating, has a black outer border and in the transition area golden ochrous. The margin is golden ochrous, with the inner border dusted with crimson scales, including the small dent pointing to the black L-shaped discal spot (sometimes separated by showing parallel wedge on the inner cell vein and a small tangential spot towards costa).

Diagnostic details: at meeting point postmedian with costa the long hair fringe has a crimson/black/golden

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ochrous section, fb a narrow parallel white protrusion along costa into the golden ochrous marginal.

Observed variation: the degree of crimson on the fw. transverse fascies ranges from light dusted on golden ochrous to fully dominating crimson. In the described ♂ holotype (Černý 1993) from the Central mountain range of Mindanao, the golden ochrous underlying colour strongly dominates.

> **Recent distribution records** of *C. alexi* ♂♂, all Philippines: **Mindanao:** 2 ♂♂, Agusan Sur, S Mt. Hilong-Hilong, 34 km E Ampayon, 470 m, 8°58' N, 125°49' E, 30. VI. 2005. 2 ♂♂, Surigao Norte, Lianga Hinayan, 13 km W Diatagon, 350 m, 8°42' N, 126°5' E, 3.–7. VII. 2005. 3 ♂♂, same locality, 29. XI.–1. XII. 2005, J. H. Lourens & A. Schintlmeister leg.; 1 ♂, Davao Sur, Baracatan, E slope of Mt. Apo, 1050 m, 7°0.513' N, 125°22.498' E, 4.–5. V. 2008. — **Leyte:** 2 ♂♂, SE region, Libertad near Tibo, 10°40' N, 125°6' E, 5. X. 2005. 1 ♂, SW region, 20 km N Maasin, Hinapu Dacu, 600 m 10°16' N, 124°55 E, 6.–7. X. 2005. 2 ♂♂, SE region, Libertad Brgy. Imelda, Katipunan, 300 m, 10°43' N, 125°4' E, 28. XI. 2005, J. H. Lourens & A. Schintlmeister leg. 4 ♂♂, NW region, 12 km E Ormoc, Lake Danao, 650 m, 11°4' N, 124°42' E, 29.–30. VI. 2006. — All specimens leg. J. H. Lourens, except where indicated otherwise; in CLJP.

For the sake of completeness, the diagnostic wing features of the following 2 members of this subgroup, *C. v-nigrum* and *C. euryxantha,* are concisely being described, highlighting the configuration of especially the basal fasciae, to enable direct comparison with the other members of this subgroup. The elements of this comparison, especially those of *C. v-nigrum v-nigrum* and *C. v-nigrum visaya,* were described in detail by Černý (1993), but seen and described here, in perspective to an observed development trend of the basal white spot, regarding shape modifications, positioning, reductions or enlargements of sections and contrasting elements, which seem just only individual minor feature variations, but appear to be quite valuable, when considered as a morphological structural entity.

Cyana v-nigrum (Černý, 1993) and *Cyana euryxantha* (Hampson, 1914)

Cyana v-nigrum v-nigrum: Fig. 5a ♂, Fig. 5b ♀; genitalia described and compared in Tab. 1: ♂ GP JHL 08LT39 (illustrated in Figs. 5c–5h) and Tab. 2: ♀ GP JHL 08LT40 (illustrated in Figs. 5i–5k).

Cyana euryxantha: Fig. 6a ♂, Fig. 6b ♀; genitalia described and compared in Tab. 1: ♂ GP JHL 08LT41 (illustrated in Figs. 6c–6g) and Tab. 2: ♀ GP JHL 08LT42 (illustrated in Figs. 6h–6i).

♂♂ of these similar species can be separated on basis of the wingshape: *C. v-nigrum* having a tornal extension under the apex of the fw. with a V-shaped discal spot, and *C. euryxantha* a rounded wing with a cell spot split into 2 parts.

However, these criteria do not always hold in those somehow intermediate (hybrid?) populations which can be found locally: they were observed in South Luzon and (at a much lower frequency) in Eastern Luzon at the costal side of the Sierra Madre Mts. (see population variability below). Variable and overlapping features (especially in ♀♀) of these species make it sometimes hard to identify them. A further diagnostic criterion is the presence of 2 lateral white half rings of the tibia in ♂ and ♀ *C. euryxantha,* which are absent on the uniform ochrous brown tibiae of *C. v-nigrum*.

Concise description of differential criteria for ♂♂ of *C. v-nigrum* and *C. euryxantha,* based on wing features: The general facies of the wing in *C. v-nigrum* is darker than in *C. euryxantha,* in which the white ground colour is brighter and more dominant. In most cases the cilia of the fw. of *C. euryxantha* are clear white. The basal white spot section above R narrower in *C. v-nigrum,* but wider in *C. euryxantha,* expanding over the veins. In the NE Luzon population: the oppositely pointing black dens are closer in *C. v-nigrum* than in *C. euryxantha*. The marginal section of the basal white spot is smaller in *C. v-nigrum* than in *C. euryxantha*. The subbasal fascia is on the margin diagonally running to the submedian, heavier (7–9 mm) and slightly wider than in *C. euryxantha* (5–6 mm). The antemedian inner black border meets the costa almost perpendicular in *C. v-nigrum*, in *C. euryxantha* obliquely versus base. The marginal section of the basal spot is always smaller in *C. v-nigrum* than in *C. euryxantha*. The black outer margin of the postmedian runs from the forewing dorsum in a straight line to the radius and fades out near the costal fringe. In *C. v-nigrum* this line is uninterrupted; in *C. euryxantha* this line is deeply pointed inwards, open and white, with the postmedian ochrous section as a dent in front of it.

Description of the ♀♀

All the above described "basal spot" parameters do similarly apply for differences between ♀♀ and are even more obvious, because of the larger size of the basal spot in this sex. Although in ♀♀, the outer black border of the postmedian reaches the costa, the Cu interruption criterion remains valid, and is only seen in *C. euryxantha*.

In *C. v-nigrum* the white background zone between the median veins is often merged at the outer half, and sometimes also merged at the costa, above the single cell spot. This upper merging is not seen in any of the *C. euryxantha* specimens.

Subspecific variation:
Cyana v-nigrum visayana (Černý, 1993) **comb. rev.**

On the basis of the above investigated features, this subspecies could likely be raised to species level, provided that supporting genitalia structures would justify this. Its status and another potential subspecies from Panay will be dealt with in forthcoming zoogeographical evaluations, once data are processed.

Population variability: In South Luzon, Sorsogon, 10 km E Irosin, Mt. Bulusan volcano lake, 12°45' N, 124°4' E, 280 m, 1 ♂ on 27. III. 2005 (J. H. Lourens leg., in CLJP) and 6 ♂♂ on 25. XI. 2005 (J. H. Lourens & A. Schintmeister leg., in CLJP) were collected which by numerical frequency incidence of described wing features could

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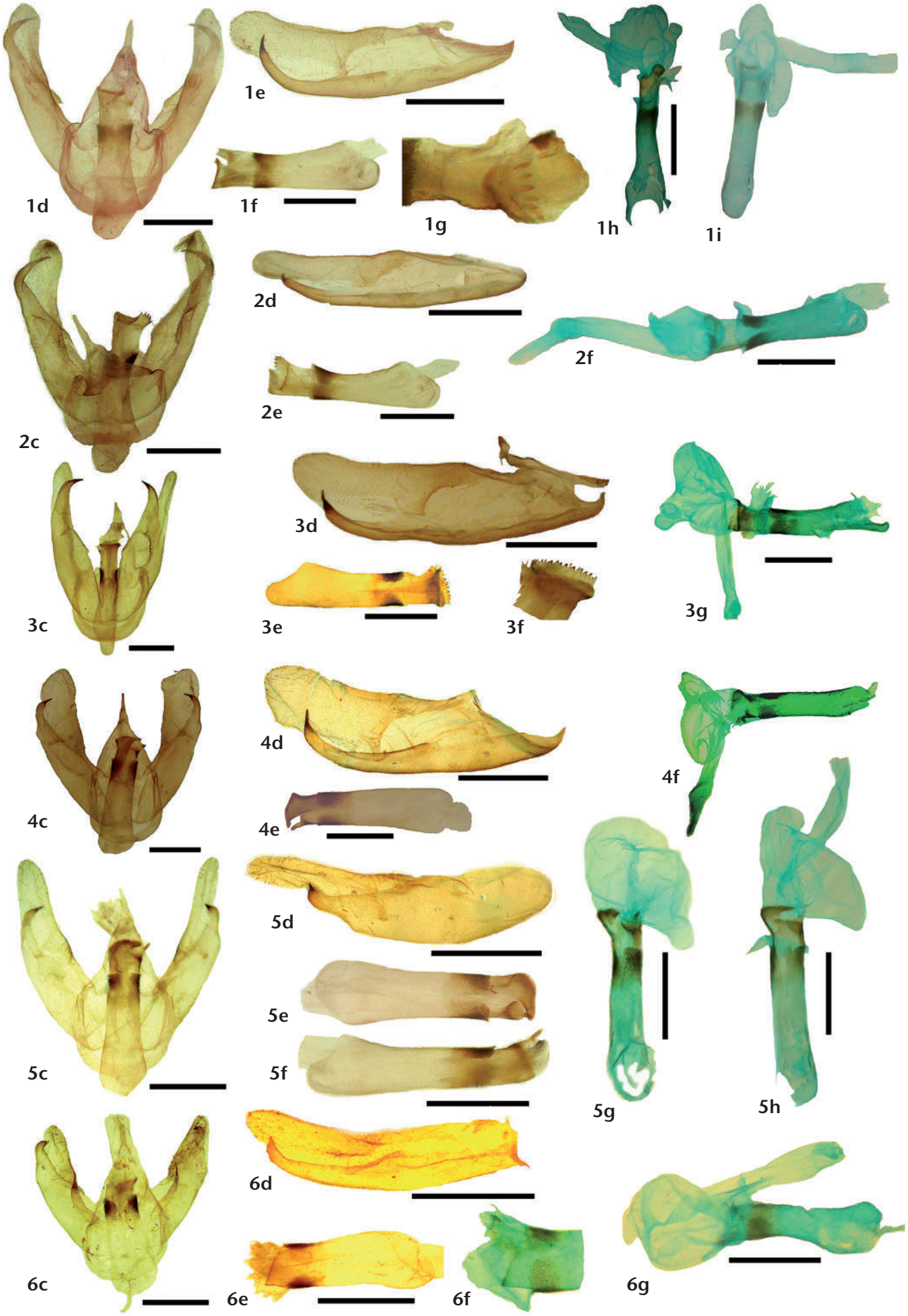

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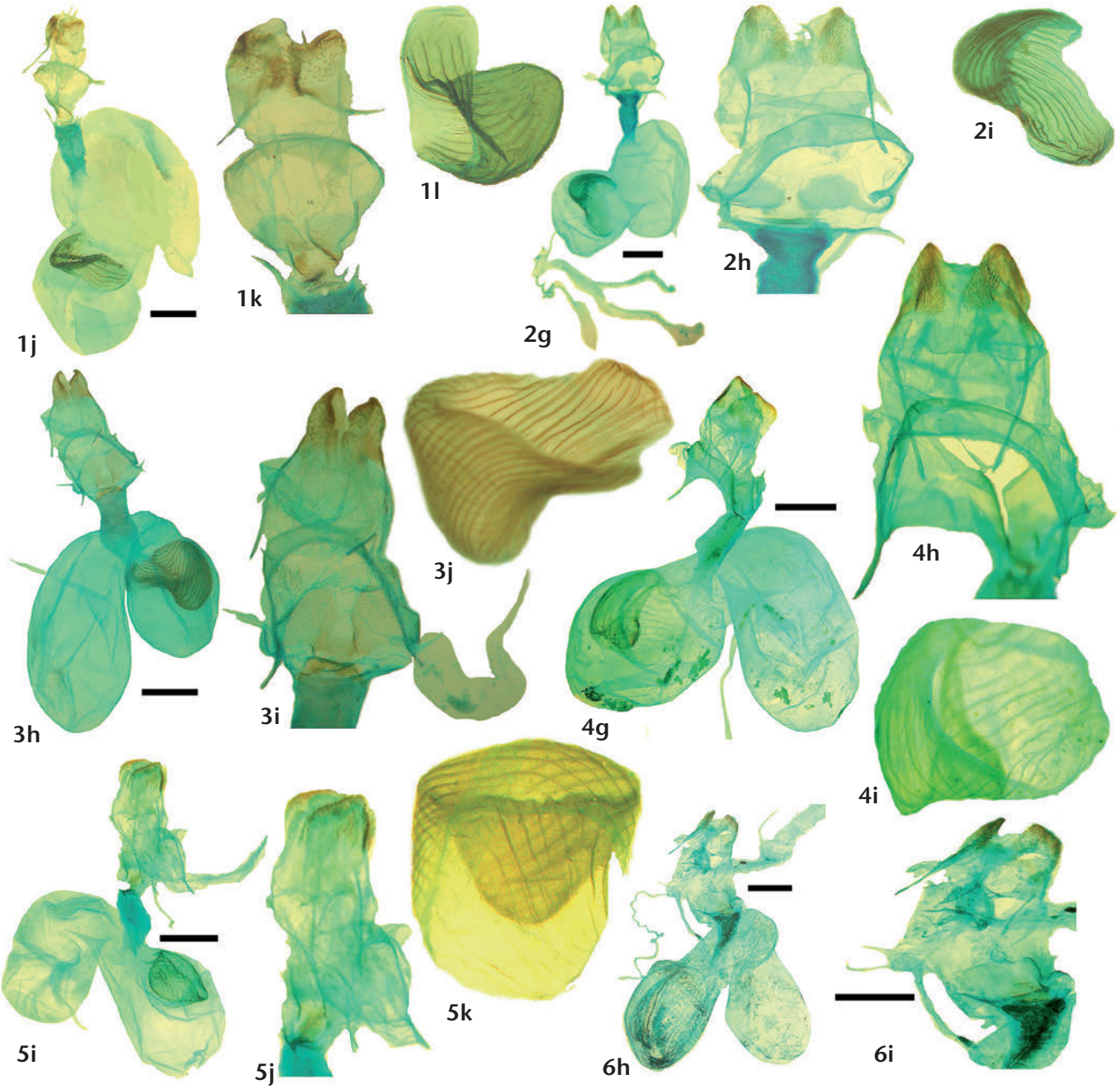

Plate 2: ♂ genitalia structures of *Cyana* species. Abbreviations: overview armature = **arm,** right valve lobe proxilateral = **val,** phallus hull = **hull,** corona teeth on rim (apex) of the phallus hull = **cor,** ejected vesica = **ves** (for replicates: ves1, ves2). — **Figs. 1d–1i:** *C. janinae* n. sp., GP JHL 08LT33; **1d** arm, **1e** val, **1f** hull, **1g** cor, **1h** ves1, **1i** ves2. **Figs. 2c–2f:** *C. lunulata,* GP JHL 08LT35; **2c** arm, **2d** val, **2e** hull, **2f** ves. **Figs. 3c–3g:** *C. phycomata,* GP JHL 08LT37; **3c** arm, **3d** val, **3e** hull, **3f** cor, **3g** ves. **Figs. 4c–4f:** *C. alexi,* GP JHL 08LT43; **4c** arm, **4d** val, **4e** hull, **4f** ves. **Figs. 5c–5h:** *C. v-nigrum v-nigrum,* GP JHL 08LT39; **5c** arm, **5d** val, **5e** hll1, **5f** hll2, **5g** ves1, **5h** ves2. **Figs. 6c–6g:** *C. euryxantha,* GP JHL 09LT41; **6c** arm, **6d** val, **6e** hull, **6f** cor, **6g** ves. — Pictures not to the same scale; scale bar (where present) = 1 mm.

Plate 3: ♀ genitalia structures of *Cyana* species. Abbreviations: overview entire structures = **situ,** details of atrium copulatrix with pad-like structures = **ac,** details of bursal plate in the bursa copulatrix = **bp. Figs. 1j–1l:** *C. janinae* n. sp., GP JHL 08LT34; **1j** situ, **1k** ac, **1j** bp. **Figs. 2g–2i:** *C. lunulata,* GP JHL 08LT36; **2g** situ, **2h** ac, **2i** bp. **Figs. 3h–3j:** *C. phycomata,* GP JHL 08LT38; **3h** situ, **3i** ac, **3j** bp. **Figs. 4g–4i:** *C. alexi,* GP JHL 08LT48; **4g** situ, **4h** ac, **4i** bp. **Figs. 5i–5k:** *C. v-nigrum v-nigrum,* GP JHL 08LT40; **5i** situ, **5j** ac, **5k** bp. **Figs. 6h–6i:** *C. euryxantha,* GP JHL 09LT42; **6h** situ, **6i** ac. — Pictures not to the same scale; scale bar (where present) = 1 mm.

be attributed to be *C. v-nigrum*, especially because of an uninterrupted postmedian outer black margin, however they did have 2 black cell spots, and the white tibia spots only expressed on one lateral side.

In view of the homozygote genetical constitution of ♂♂, this can phenologically most likely have arisen from a not fully compatible expression defect caused by a foreign, closely related allele, in a hybrid situation. In Sorsogon the frequency was 17 %, whereas along the East Sierra Madre Coast in NE Luzon 10 %. No intermediates were seen in the very North and NW of Luzon.

Recent distribution records, *Cyana v-nigrum v-nigrum*, all from Philippines, **Luzon:** 2 ♂♂, East, Infanta, Sierra Madre, along Pisa river, Bgy. Magsasay, 100 m, 14°44' N, 121°37' E, 1. IV. 2004. 3 ♂♂, Infanta, Sierra Madre, 10 km W Gen. Nakar, 70 m, 14°45' N, 121°36' E, 7. V. 2004. 3 ♂♂,

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1 ♀, Quirino, 35 km E Naptipunan, Settlement Pul Lupa, 300 m, 15°58' N, 121°29' E, 11.–12. III. 2005. 2 ♂♂, Nueva Ecija, Bongabon Mingan Mts., Bgy Laby, 500 m, 15°38' N, 121°15' E, 8. VI. 2005. 6 ♂♂, Aurora/Infanta border, Dinapique, 13 km W Dibulo, 550–585 m, 16°32' N, 121°146' E, 21.–22. IX. 2006; 10 ♂♂, same locality, 14.–15. VI. 2007; 6 ♂♂, same locality, 21.–23. II. 2007; 3 ♂♂, nearby, 16°32.866' N, 122°14.133' E, 24.–25. IX. 2008. 3 ♂♂, 1 ♀, Aurora, 14 km S Dilalongan, Dapalan river, Sierra Madre, 50 m, 16°62.707' N, 121°42.073', 4. IX. 2007, E. K. KNOBLICH & J. H. LOURENS leg. 1 ♂, Central, Kalinga, 2 km E Supau, Acacia Escarpment, 480 m, 17°23' N, 121°11.252' E, 7. II. 2007, J. H., K. D. & M. S. LOURENS leg. 1 ♀, North, Apayao, Adams Pagudpud, Brgy. Pantiang, Managa river, 340 m, 14°45' N, 121°36' E, 21. IV. 2007. – **Marinduque**: 4 ♂♂, Danao, 5 km N Malibago, 150 m, 13°18' N, 121°59' E, 20. V. 2004. 1 ♂, Sinambulan Mts., 200 m 13°19' N, 121°58' E, 24. V. 2004. 3 ♂♂, 22 km W Torijos, 400 m, 13°22' N, 122°2' E, 7. V. 2005. – All specimens leg. J. H. LOURENS, except where indicated otherwise; in CLJP.

Recent distribution records, *Cyana euryxantha,* all from Philippines, **Luzon:** East, 2 ♀♀, Nueva Ecija, Bongabon, Brgy. Laby, Mingan Mts., 700 m, 15°38' N, 121°15' E, 15. VIII. 2005; 2 ♀♀, nearby, 950 m, 16.–17. VIII. 2005; 4 ♂♂, 5 ♀♀, nearby, 7.–9. IX. 2005; 1 ♂, 3 ♀♀, dto., 26.–27. IV. 2006; 1 ♀, dto., 6.–7. IX. 2006. 1 ♂, Aurora/Isabela border, Dinapique, 13–17 km W Dibulo, 550–650 m, 16°32' N, 122°14' E, 3. IX. 2006; 8 ♂♂, 2 ♀♀, dto., 21.–23. IX. 2007. 9 ♂♂, Isabella Prov., Barangay (Brgy) W. Ango, W. Ango, 21.–23. II. 2007; 9 ♂♂, 5 ♀♀, dto., 14.–17. VI. 2007; 18 ♂♂, dto., 21.–23. IX. 2007; 1 ♂, dto., 11. II. 2008; 1 ♂, dto., 24.–25. IX. 2008. North: 1 ♀, Ilocos Sur, E Suyo, 90 m, 16°57' N, 120°49' E, 2. II. 2005. 1 ♂, Apayao, SE Pagudpud Adams, 340 m, 18°25.709' N, 120°55.259' E, 20. IV. 2007. Central: 2 ♂♂, 1 ♀, Abra/Kalinga border, E Malibcong, 1250 m, 15°38' N, 121°15' E; 1 ♀, dto., 17.–18. IV. 2007; 1 ♀, dto., 3.–4. IV. 2008. 2 ♀♀, Kalinga, E Supau, 80 m, 17°23.166' N, 121°11.252' E, 7. II. 2007. – All specimens leg. J. H. LOURENS; in CLJP.

Interpretation of ♂ genitalia components in the *C. lunulata* group

(Table 1)

The ♂ genitalia of this group of species show a high degree of homogeneity, with obviously clear evolutionary trends, and may therefore have significant relevance for classification.

Group properties had already been identified in the possession of a terminal scobination of the phallus hull and the presence of a backward pointing sturdy bushel of hairs at the apex of the valves' lobe (costal part of the valves). ROEPKE (1927) found major differential features in structure variations of the lobes to identify 14 species from Java at his timeTherefore the **lobe morphology** of the valves was particularly investigated. It was found that the lobes of all 6 species in this group had a similar construction, although with some variation within. The distal half of the lobe is always darker, which, with the use of small air bubbles, could be diagnosed to consist of 2 layers.

This double section is referred to as "lining". It arises from the dorsal edge of the valve, probably as a former broad lobe. In *C. janinae* sp. n., the lobe does not fully reach the opposite border, and in *C. alexi* it is connected to this by 2 narrow bands. Support for this assumed event is provided by the genital figures of *Cyana maiae* HOLLOWAY 2001 (see HOLLOWAY 2001: pl. 1, fig. 9; figs. 128 [♂], 139 [♀]), which carries such a wide (species-specific) enlargement, as well as a long tubular lobe on the vesica base, by which its close relationship to the Philippine *C. lunulata* group is further supported.

The male valves, illustrated in proxilateral position (Figs. 1e, 2d, 3d, 4d, 5d, 6d), also show the dimensions of the harp (cucullus?) versus the lobe end and the various longitudinal compressions and folds given in Tab. 1. From the dorsal centre of the valve (towards the connexion to the juxta) there is in all species an inwardly folded section of the lobe: referred to as antesacculus. The described variables are complex, but are believed to be major features for ranking.

Phallus structures: Most earlier published ♂ preparations do not, or incompletely show details of the apex, to be able to identify fine structures, although a "fingerlike terminal projection" was once described for ♂ *C. v-nigrum*. Small dentate structures were seen in 4 species of this group, all species investigated had also larger lateral dents, or pointed plates arising from an anvil-shaped cuff at the apex.

Classification on basis of small teeth alone doesn't hold and therefore was complemented by the possible parallel development line of the large lateral thorn on the plates, forming pairs with the (contracted?) larger single tooth, originating from the same corona base in *C. alexi* and *C. v-nigrum.*

Vesica structures: Duplicate preparations (*C. janinae* Figs. 1h, 1i; *C. v-nigrum* Figs. 5g, 5h) demonstrate a high degree of conformity of all vesica lobe details, even in (unfortunately, most) incompletely ejected vesicas. In Fig. 5g the tubular lobe inside the phallus hull can be seen, covering the full length of the phallus, making it almost impossible to get it out undamaged. The 0.3 mm diameter tubular extensions of the vesica protrude under species specific angles. The protruded lobe is internally supported and held in position by hyaline, sometimes lightly sclerotized blade like structures. Note: upon the moment of ejection, a click-in locking structure inside the central vesica lob is triggered. It brings the expanding lobe 3 dimensional in position. This mechanism is also seen in other species like *C. vespertata* (ČERNÝ, 1993) but the feathery structures only in this group.

The three-dimensional shape of the structures is a major criterion for understanding relationships within species of this group, but its value for establishing trends could not be fully understood.

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Tab. 1: Dimensions and description of ♂ genitalia components. — Notes: all measurement pairs as length × width and in mm, unless otherwise indicated. Structure sizes always measured at the centre, or indicated. Vesica protrusions from plane projection measurements on an enlarged printout copy. Abbreviatios: bas. = basic (central) lobe, aux. = auxiliary or tub. = tubular lobe of the vesica, followed by positioning indicators, such as C = caudal, D = dorsal, L = lateral (if >1, followed by numbers 1, 2 etc.), V = ventral. Basic lobe defined by containing a lock-in mechanism structure, especially noticeable during ejection.

Cyana sp.	Valve lobe structures	Phallus hull	Phallus rim	Vesica lobes	3-D configuration
***C. janinae* n. sp.** GP JHL 08LT33, 09LT49 (Figs. 1d–1i)	2.9 mm × 0.45 mm Symmetrically pointed apex, laterally compressed. Inner border of transverse double lining (dark distal half) ¼ circular basad concave. Pseudosacculus 0.22 mm and sacculus ridge 0.14 mm at the centre. Harpe base wide, regularly thinner towards tip, wide inwardly curved.	2.3 mm × 0.45 mm (values measured at the centres) *Ductus seminalis* (ds) entering 0.26 mm from the base, at which point the shaft is broadened to a width of 0.65 mm.	Slightly sclerotized platelet covering one third of the rim circumference, with fine longitudinal ribs, 3 rudimentary small teeth arising herefrom, oppositely a half circular, ribbed plate with a lateral thorn.	bas.: 0.92 mm × 0.58 mm tub.: 2.16 mm × 0.3 mm aux L1: 1.13 mm × 0.35 mm aux L2: 0.53 mm × 0.3 mm	tub.: Inclination 90° versus phallus hull. At ¾ of its length with an annular structure over a distance of 0.4 mm.
C. lunulata GP JHL 08LT35 (Figs. 2c–2f)	3.0 mm × 0.44 mm Lobe almost straight, dorsal half of the lining heavier structured, inner border diagonal: apex rounded, spatula-shaped, sacculus width 0.18 mm, antesacculus 0.82 mm × 0.09 mm, connecting narrowly with the transverse lining border.	2.47 mm × 0.35 mm At its base widened to 0.58 mm with ds entering at the base of the lateral extension to half the diameter of the hull.	7 small teeth on one side and on the other side a semi-circular triangular structure, which is sclerotized at the edge and carries a lateral thorn.	bas.: 0.94 mm × 0.94 mm a small aux C: 0.4 mm × 0.3 mm caudal extension tub.: 3.1 mm × 0.3 mm	tub.: pointing 140° forward, with the last (0.76 mm) section of the lobe bending 34° inwards out of an annular thickened 0.4 mm section.
C. phycomata GP JHL 08LT37 (Figs. 3c–3g)	3.47 mm × 0.93 mm Apex rounded, flat, no folds or ridges. Inner border of transverse double lining ¼ circular, with a small radial arc, arising from a solid base, merging with the inner base of cucullus. Pseudosacculus short, 0.1 mm wide and sacculus 0.13 mm wide. Harpe thin, straight and slightly inwardly bent, with a narrow tip.	2.52 mm × 0.48 mm At the base there is a spoon-shaped lateral sclerotized section of 0.29 mm, mimicking a processus on one side. Ds enters laterally on 0.42 mm from the base.	At the base, there is a robust semi-circular ring-shaped plate with one inwardly directed thorn and a dull lateral bulge. Out of the rim there is a corona with 16 small teeth covering half of the hull diameter.	bas.: 0.51 mm × 0.55 mm aux L1: 0.85 mm × 0.7 mm aux T: 2 mm × 0.19 mm tub.: 1.74 mm × 0.19 mm auxV: 0,18 mm × 0.2 mm	tub.: at an almost perpendicular 80° angle versus the hull. At its end an annular ring and a darker, non-ejected section. In the tubulus there is a sword-like object of 0.55 mm length.
C. alexi GP JHL 09LT43, 09LT44 (Fig. 4c–4f)	3.42 mm × 0.78 mm Apex ending in a wide, half rounded blunt point, with a narrow stretch of the top margins folded inwards. Inward border of lining ¼-circular ending in the broad based antisacculus. Ventral edge meeting cucullus by two bridges. Sacculus rim 0.33 mm wide. Harpe, solid in structure, with a wide inward curve and a prominent tip.	2.51 mm × 0.54 mm Symmetrical, slightly narrowing from base to apex. Ds entering at the rounded basis over four fifths of its length.	One large ¾-circular terminal plate sclerotized on one side, anvil-shaped, with a large lateral sharp thorn. The other end with a blunt, 0.1 mm lomg thorn and fibrillose, fishtail-like 0.1 mm lobes.	bas.: 0.56 mm × 0.55 mm tub.: 2.1 mm × 0.24 mm auxV: 1.1 mm × 0.67 mm auxD: 0.54 mm × 0.43 mm	Tubular lobe arising ventrally from the base lobe, at an 110° angle, pointing sidewards. A needle-like structure in its base. The last 1 mm slightly sclerotized and narrowing towards the end, out of a light bulge.
C. v–nigrum v-nigrum GP JHL 08LT39 (Figs. 5c–5h)	2.90 mm × 0.64 mm Apex pointed and with a longtitudinal fold. Inner borders compressed. Inner margin of lining slanting, slightly concave towards the juxta. Pseudosacculus short, narrow, 0.09 mm at base. Sacculus stretched over full width of lobe. Cucullus base points inwards and is strongly bent and at the costa strongly compressed just before the curve. Harpe with a broad base, constricted over the last 20% of its length, and a short, broad inward tip.	2.27 mm × 0.46 mm Club-shaped, widened at the base to 0.67 mm. Ds entering over half the width on the wider, slightly slanting, expanded side of the base.	A circular plate in ¾ of the circumference. Both sides of the rim ending in a thorn, but not in the same plain; one spiralling down. The lower thorn carries a 0.13 mm long tooth out of a triangular base. The tooth ends at the tip of the lowest lateral thorn.	bas.: 1.0 mm × 0.46 mm tub.: 2.18 mm × 0.28 mm aux L1: 0.83 mm × 0.41 mm aux L2: 1.1 mm × 0.89 mm auxC: 0.3 mm × 0.51 mm, croissant-shaped	tub.: originates from the ventral centre of the base, pointing forward, at an angle of 108 ± 6° versus the shaft (n =3), the ejected tubuli [possibly] being not fully stretched.
C. euryxantha GP JHL 08LT41 (Figs. 6c–6g)	2.90 mm × 0.75 mm Apex almost rounded and bluntly pointed. Inner margin of the lining convex, not fully reaching ventral, with several almost parallel ribbed structures. Pseudosacculus 0.95 mm long and 0.11 mm wide, sacculus at the centre bulgy, folded over half the lobe diameter.	1.77 mm × 0.52 mm Wider at its base: 0.58 mm, reduced to 0.47 mm at the scobination zone. Basis asymmetrically rounded. Ds enters at the centre of the base.	A diamond-shaped, slightly slanting, pointed plate between the lateral scobination fields, and one strong, outwardly pointing thorn with a solid base opposite, visible after ejection of the vesica.	bas.: 0.94 mm × 0.59 mm tub.: 1.72 mm × 0.31 mm aux L1: 1.09 mm × 0.5 mm auxC: 0.15 mm × 0.44 mm	Arising ventrally from a fold between the base and lateral lobe, pointing backwards under a 29° angle.

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Interpretation of ♀ genitalia components in the *C. lunulata* group

(Table 2)

In general, the ♀ structures were found to be less homogeneous than those of the ♂♂. Discrepancy was experienced in some descriptions on the designation of **bursa**/**pseudobursa** by Holloway (2001). In *C. janinae* sp. n. and *C. lunulata* the ductus bursae does not enter the lobe which carries the plate structure. Based upon 8 further dissected species of the *C. geminipuncta* and *C. vespertata* groups, where this is always the case, the situation in *C. janinae* and *C. lunulata* is rather considered an exception. Therefore it is supposed that the pseudobursa might have undergone extension and the ductus entry has not kept pace with it. In the other 4 species, the ductus bursae enters the plated lobe, although the pseudobursa

Tab. 2: Dimensions and description of ♀ genitalia components. — Legend: Measurements always length × width, taken at the centre of objects reconstructed from projection of (partly in situ) photos. Notes: Since there sometimes exists a discrepancy regarding allocation of bursa or pseudobursa, the *Bursa copulatrix* is defined here as the one carrying the structural plate. In view of this, reproductive anatomical observations, although believed to be of high value for lineage reconstruction, cannot (yet) be fully interpreted, but are, however, described when seen. It was observed that all members of the Philippine endemic *C. lunulata* group possess an "elbow"-shaped structure, to which the *Ductus seminalis* connects. This structure is called *Receptaculum seminalis* (rs). This could be recognized from similarities with the ones in the *C. vespertata* and *C. geminipuncta* groups, where this structure is proportionally much larger. The vascular and glandular system components (such as shown in Fig. 4a, 6b and 12a) are in need of exact anatomical clarification and definition before these can be used for classification.

Cyana sp.	Atrium copulatrix (ac)	Ductus bursa (db)	Bursa copulatrix (bc)	Pseudobursa (pb)
***C. janinae* n. sp.** GP JHL 08LT34 (Figs. 1j–1l)	1.15 mm × 0.42 mm Distally 2 oval pads with light sclerotisation, increasing towards pointed inner base, resting upon a central (heavier) sclerotized structure at the dorsal side of db.	1.08 mm × 0.33 mm Thinly built, with light longitudinal ribs. A small rs of the ductus seminalis is attached to the rim of the db mouth.	1.67 mm × 1.44 mm Hyaline, slightly oval. The top of the cup-shaped plate points laterally. From cup centre arises a broad ligula with 6 longitudal ribs, which point slightly to the side.	2.5 mm × 1.83 mm Attached at two thirds of proximal side of the bc by a 1 mm transverse fissure. A broad duct arises from the funnel-like widening base, just before the end.
C. lunulata GP JHL 08LT36 (Figs. 2g–2i)	1.0 mm × 0.27 mm Distally with 2 broad oval pads lying perpendicular: without sclerotisation but solid in structure.	2.47 mm × 0.35 mm Heavily longitudinally ribbed, with a small constriction just after the mouth. The rs and glandular system along the ductus, attached to the rim	0.81 mm × 1.09 mm Hyaline, almost circular. The top of the cup-shaped plate points proximally. The 0.72 mm long ligula directs to the end of the bursa, with 9 longitudinal ribs, terminally crincled.	1.72 mm × 1.13 mm Egg-shaped, placed proxilateral versus bc. Attached to it over a 0.73 mm fissure at two thirds of the distal end. A broad duct enters the bc just before the end with a widening base, funnel-like.
C. phycomata GP JHL 08LT38 (Figs. 3h–3j)	1.82 mm × 1.13 mm Broad, dorsally sclerotized. Pads sclerotized, diagonally placed, with triangular inner projections towards the db mouth, resting on a narrow flat sclerotized base at the opening of the db.	1.30 mm × 0.52 mm The centre slightly constricted, distally ending conical. Rs 0.41 mm, relatively large, attached laterally, at the level of the pads.	2.0 mm × 1.74 mm Hyaline, oblong. Plate cup-shaped, laterally stretched on one side: with an insulcation at the top of the cup. Ligula long, with 15 longitudinal ribs, pointing towards the v-shaped ending of db.	4.26 mm × 1.72 mm Pear-shaped, base connected apically to bc. Dorsally slung over around the db with half a circle. A duct entering at half of its length
C. alexi GP JHL 09LT48 (Figs. 4g–4i)	1.87 mm × 1.25 mm Broad, dorsally sclerotized. Pads oblong with diamond-shaped inner borders, firmly anchored to db mouth.	1.31 mm × 0.5 mm One side straight, opposite side bulging in the centre, gradually decreasing towards the mouth. Rs and glandular structures aside of db.	2.62 mm × 2.19mm Hyaline, oval with a lateral protrusion to the psb. Plate moon-shaped, one side compressed, the top of the cup pointing sidewards. Ligula perpendicular, with 12 ribs.	3.43 mm × 1.93 mm Shaped like a symmetrical potato tuber, slung dorsally around the db, curved inwards at almost 90° duct, with a duct arising at two thirds from the apex.
C. v–nigrum v-nigrum GP JHL 09LT40 (Figs. 5i–5k)	2.54 mm × 1.18 mm A strongly sclerotized base touching the aperture of db with proximally 2 half-circular pads with straight sides.	0.9 mm × 0.64 mm Bulged on both sides, strongly longitudinal ribbed at the mouth. A 1.45 mm glandular structure, laterally attached to the proximal side of ac to where the ds leads.	3.45 mm × 2.55 mm Hyaline. A symmetrical cup with a deep regular lateral insulcation, placed diagonally in the proximal part, lying on its side. Ligula points towards db, with 12 thin ribs.	3.36 mm × 2.27 mm Shaped like a symmetrical potato tuber, perpendicularly attached to the upper side by a 1 mm transverse fissure. A wide duct proximally at two fifths from base, towards the glandular structure aside ac.
C. euryxantha GP JHL 09LT42 (Figs. 6h–6i)	1.87 mm × 1.06 mm Broad prominent sclerotized pads dorsally with light setae, pointing outwards. Inner borders rounded.	Length 1.16 mm Triangular, distally with longer point, laterally anchored to upper half of db. Rs in centre of ac, medium-sized rs with wide duct to pb.	4.43 mm × 1.18 mm (proximal half), 1.81 mm (distal half). Main conical body darkened by longitudinally ribbed structures. Conical, proximal narrower than the solid oval end. Plate reduced to umbrella with the top towards db. Ligula all over, ribs number at one side approximately 12 but not fully assessible.	3.0 mm × 1.81 mm Shaped like an asymmetrical tuber, similar as terminal half of bc. Connected to bc by a narrowing 0.75 mm ribbed funnel section. Hyaline, but similarly shaped as bc. Bursae in one plain, at an approx. 30° angle. A wide (ovi-?)duct to rs.

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is strongly elongated in *C. phycomata* and *C. alexi,* slung over dorsally around the ductus bursae, running over the ventral side of the bursa and expanding backwards. In *C. euryxantha*, the pseudobursa is fully separated by a ribbed, circular constricted funnel-shaped ligament.

A possible trend would be its elongation and the degree of pseudobursa differentiation.

Bursal plates have close structural similarity in all 6 species, the least in *C. euryxantha*, where it is split into 2 sections connected by elongated heavy parallel ribs, which also frame the basis of the pseudobursa. They are specific for each species, and have a cup-shaped snail-like base with a wide tongue of variable lengths and numbers of parallel ribs.

Ranking criteria could be the structure simplicity rating, complemented by the degree of ligula expansion and the number of longitudinal ribs.

The **atrium copulatrix** (Figs. 1k, 2h, 3i, 4h, 5j, 6i) carries pad-like structures just before the mouth of the ductus bursae. They are oval in *C. lunulata,* and distally slightly sclerotized in *C. janinae* sp. n., slightly triangular, larger in *C. phycomata,* with a sclerotized base towards the ductus bursa, strongest in *C. alexi* and with the widest base in *C. euryxantha*.

It would be desirable to understand the function of this structure, positioned at the dorsal section of the atrium copulatrix. There seems to be a trend in the shape, from oval to triangular, and the degree of scerotization of the connecting base.

The entry point of the **ductus seminalis** (ds) has often been noted by Černý (1993), and is certainly a valid structural criterion. In the species of the *lunulata* group it always connects to an elbow-shaped structure, positioned lateral to the atrium copulatrix or attached to the rim of the ductus bursae mouth (see Fig. 2g *C. lunulata,* Fig. 6h *C. euryxantha*), where it has been dissected. The ds enters this observed receptaculum, from which there runs a relatively wide vascular connection to the pseudobursa. In *C. janinae* and *C. lunulata* the duct connects to the distal end of the pseudobursa. This receptaculum is usually very small in this group and has a characteristical elbow-shape. In *C. phycomata* (Fig. 3i) is the largest in this group. It is very large, but still has its typical shape in the *C. geminipunctata* and *C. vespertata* groups from where, in these species, the pseudobursa emerges.

Prior to use this criterion, the anatomy and nomenclature of the vasculae has to be defined.

Discussion

This study involves only endemic species of the Philippines, and therefore this classification attempt can only be a preliminary exercise, since detailed data are only available from 6 species in this *C. lunulata* group, as well as 8–10 species in the *C. geminipunctata* and *C. vespertata* groups (Lourens, in preparation). Of the estimated 140 species of this genus (Kishida 1991) these represent only 10% of the known species, and about 50% of the Philippine species.

The aim of this study was to determine the taxonomical position of *C. janinae* sp. n. in a likely lineage-reflecting taxonomical system. Hereto, each of the common structural and external morphological features of all 6 investigated species in this *C. lunulata* group were separately analysed and ranked on basis of the least developed stages, under the assumption that these reflect a degree of phylogenetical relationship. The validity of this approach can, and still needs further to be proven by parallel studies on other groups of this genus. Since there was no parameter that could fully be applied over all 6 species, the covering trend lines were completed with segments from parallel trend lines derived from other structures.

The following trends were seen:

1. those that contribute to coupling of the partners (lobe-structures);
2. those that are involved in precise ejection of the vesica (corona and phallus cuff); and
3. those that target precise positioning of the tubular lobes of the phallus vesica (angles supporting structures).

- Ad 1: the lobe structural layout plan with folded-over sections of the lobes, borders or lateral compression, point at promoting sturdiness of this coupling structure. By comparing the structure variations with others, it will be possible to decide what is advanced or basic.
- Ad 2: there are clear trends seen in the number of phallus corona dents: 6, 12, 16 and the development of one broad finger-like out of these, all at the base of the vesica, forming a matching partner with structures/thorns on the phallus cuff. These directly determine the position of the vesica base. The phallus itself, is (perhaps) held in position by “pads” in the atrium copulatrix
- Ad 3: the described 3-dimensional vesica configurations, especially the lock-structure inside the tubular lobe must have an affinitity to the ductus bursae configurations.

There should be an explanation for the long tubular lobe on the vesica base, apparently directing towards the bursae copulatrix plates, which are always placed in the apex of the bursa.

Trends in colours and fasciae configurations, and compositions thereof: spots

The colour range in most Philippine *Cyana* species reaches from ocher over crimson red towards carmine. They are probably ruled by very minor shifts in reflection angles of structural elements. Their usefulness as indicators for lineage is considered small and likely subject to clinal variation. The key question for their use

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is, whether the colour changes arisen under a regime of selection pressure, are reversible. In respect to this, the following is considered. The white basal spot on the fw. (sometimes markedly bordered by a black, contrasting full or partial borderline, or indentations thereof), may have been induced by selection pressure, but is likely arranged on one single locus, since it was seen that it can shift position as an entity. It was noticed that species with a single white spot, like *C. janinae* and *C. lunulata,* are strongly bound to dense forest habitats. In these, one often finds large web spiders, such as *Argiope* spp., which display a contrasting cross-shaped pattern on the cephalothorax, whereas in more open biotopes Tetragnatidae (all Araneae) are more dominant, which have transverse lateral fasciae. Selection pressure under such regimes could initially have led to such different facies, but it is very unlikely that these fall back when the pressure seizes. From that point onward such a composite structural entity may be taken as lineage revealing parameter.

Further examples of such complexes are:

- The subbasal band has at the margin always an extension under the basal spot. In *C. v-nigrum* and *C. euryxantha,* the basal half of the white spot gets smaller. If these trends continue one ends up with a facies like *C. rosabra* (Wileman, 1925), perhaps magnified by polyploidy, for which there is an indication.
- The deep diagnostic basal indentation on the Cu of the inner border of the postmarginal fascies, seen in most members of the *C. lunulata* group, as well as in a number of Bornean species, could be of help in finding clues for phallus and cornuti development.

Preliminary classification of the 6 known Philippine species of the *C. lunulata* group based upon the above described selected mayor ranked criteria:

1: the double lining of the valve lobe,

2: phallus dentation, vesica shape with the tubular lobe,

3: the bursal cup-shaped plates with longitudinal ribs,

4: the atrium "pads", each of which has been evaluated for ranking potential.

Based hereon *C. janinae* was given 1, *C. lunulata* 2, *C. phycomata* 3, *C. alexi* 4, *C. v-nigrum* 5 and *C. euryxantha* 6. Since none of the ranking parameters extended to all 6 species, the covering trend lines were completed with segments from parallel trend lines derived from other structures, with which they are interconnected by overlap of another trend sequence or by joint features with the next. For 1–3 including low sexual dimorphy, 1–4 the basal white spot, 3–5 the phallus tip dentation, and for 5–6 the harp shape and the bursal plate ribs extension.

This study is the first of its kind and will be followed by an analysis of the *C. geminipunctata* and *C. vespertata* groups, of which there are a few crucial species and specimens still missing. It will be analysed how the assigned functional assumptions are being realized in this group. It is hoped that DNA data can be generated, for which the author will make material available on request.

Acknowledgements

I wish to thank all the people that supported me, with permission to collect in the consession areas of Pateco: Engr. Rick Cabangon, Major Candido of Casiguran; Police Chief Leandro V. Novilla in Aurora Province; and Alberto A. Plaza, Board Director of Sammilia, in Surigao Sur, Mindanao; especially Carponio Mahinay "Punjong" for his tact with Manobo Tribal Chieftains, all those who cared for my safety, especially General Federico N. Terte. For taxonomical advice I am grateful to Dr. Karel Černý, Innsbruck, Dr. Rienk de Jong, Leiden, and Dr. Alberto Zilli, Rome; for literature Dr. Wolfgang Mey, Berlin, and Dr. Alexander Schintlmeister, Dresden, and to all those who honoured my persistant requests to shoulder a few tank fillings of fuel for traveling to all these places, securely guided by driver Richard Pielago. Dr. Wolfgang A. Nässig, Frankfurt am Main, critically commented on the manuscript.

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Received: 23. ii. 2009, 3. vi. 2009

© Entomologischer Verein Apollo e. V., Frankfurt am Main, November 2009

ISSN 0723-9912

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